



## Diversity and distribution pattern of waterbirds in wetlands of Algerian steppe region

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### Abstract

The main aim of our study is to assess the diversity and abundance waterbirds through wetland ecosystems located in Algerian steppe region. a survey was conducted along four successive study years in the main sites.

This monitoring allowed assessing 52 species, representing 16 families. Anatidae are the most abundant and represented by 11 species. Boughzoul's reservoir is the high richness wetlands, followed by Chott El Hodna and K'sob reservoir. However, Dayet El Kerfa is the preferred wetland for breeding species. Winter migrant, resident, and migrant species are the dominated status with 43 %, 28 % and 17 % respectively. While these statuses varied between sites.

Overall, the analyze phonological status of assessed species display the key role played by these wetlands as wintering grounds, a stopover during migration journeys and breeding sites for several waterbirds species. The presence of vulnerable species (*Marmaronetta angustirostris*), and three near threatened other species (*Aythya nyroca*, *Limosa limosa*, *Numenius arquata*) following the IUCN Red List confirms the importance of the steppe region wetlands for waterbirds conservation.

**Keywords:** Wetland, Waterbirds, Diversity, Distribution pattern, Steppe region, Algeria.

### Introduction

Wetlands have been usually known as primary resources for human activities, as well as irreplaceable habitat for a rich diversity of flora and fauna, particularly waterbird communities (Weller, 1999). Algeria contains a wide variety of wetlands which are important staging posts and wintering grounds for migrating Palearctic birds (Stevenson et al. 1988, Coulthard 2001).

The steppe region wetlands of Algeria known by its habitat diversity (Chott, Reservoir, Daya, Dam...). Many of them are classified as wetland of international importance under the Ramsar Convention and as Important Bird Area (IBA) (Coulthard, 2001). By its strategic location in the center of the country, this complex plays a key role in the ecosystem maintains (Samraoui et al. 2008; Ledant et al. 1981).

The avifauna of Algeria is moderately well known, due former collected data during the past century by many ornithologists (Heim de Balsac & Mayaud 1962, Ledant et al. 1981, Isenmann & Moali, 2000). These early works are based on dispatched observations recorded intermittently in a few wetlands. Baseline information on the distribution and abundance of waterbirds is elementary task of further deeper research and the development of management and conservation strategies (Lancelotti Julio et al. 2009).

In North Africa and particularly in Algeria, there are major gaps in knowledge of the birds' status, distribution, seasonal movements and habitat use, particularly for wetland species Samraoui et al. 2008. These wetlands are used by a large number of wintering and breeding waterbirds (Jacob & Jacob 1980, Bensaci et al. 2014)



Waterbirds diversity and distribution of steppe region wetlands area remain poorly known, where there are few studies were carried out in some sites in this region such as Boughzoul reservoir (Jacob & Jacob 1980), Chott El Hodna (Guergueb et al. 2014), Dayet El Kerfa (Bensaci et al. 2014).

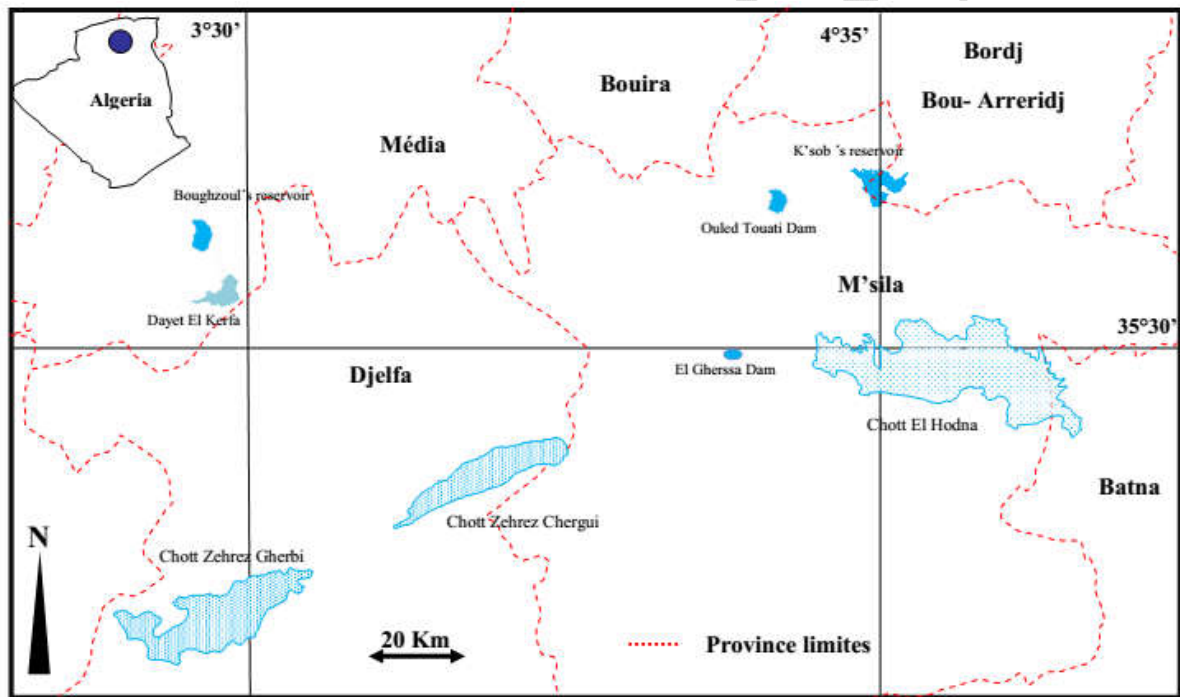
This contribution aimed to assess the diversity, phenology, and distribution of waterbirds species throughout wetlands of steppe region and to determine the opportunities offered by these habitats for the conservation of this biodiversity

## Material and Methods

The Steppe region located in northern Algeria, in an area consisting of mountains, valleys, and plateaus between the Mediterranean Sea and the Sahara Desert, where the landscape is dominated by steppe vegetation.

This huge complex has a semi-arid climate, with an annual mean temperature of 25°C and average annual rainfall less than 400 mm (Figure. 1).

The Steppe region contains many wetlands varied between natural and artificial sites, which are developed when the waters converge from the Saharan Atlas Mountains in the South and the Tell Atlas Mountains in the North. Most of these are vast, shallow salt lakes that have been little studied and are poorly known.



**Figure 1. Geographic situation of study area**

The waterbirds surveys were undertaken across eight wetlands, two of them were dry for long period (Chott Zehrez Chergui and Zehrez Gherbi) during four study years from 2012 to 2016, through many companies of bird counts during different seasons of the year. The census of the waterbirds was done by direct observation using an Optolyth 20x80 telescope by a team of 3 to 2 observer from near the wetland in different observation points, where most of the surface area and the edge was visible, in the aim to identify and count all birds present (Bibby et al. 1992).

The determination of phenological status based on the period of species occurrence in the site: resident breeder (RB) species present all the year and its nesting is confirmed during the study period; winter migrant (WM) species observed exclusively during the winter season; migrant breeder (MB) migratory species came in summer for breeding; probable breeder (PB) species supposed breeding; and visitor passage (VP) species observed occasionally in the site mainly during migration periods.



Faunal type (FT), was determined according to Voous (1960) classification of the biogeographical origin. Trophic status (TC), were distinguished according to their diet categories (Müller, 1997): granivorous (G), carrion-feeder (Cr), carnivorous (Cv), invertebrate feeder (Inv) and polyphagous (Pp).

Protection status (PRS) was determined nationally according to species citations in Algeria legislation (OJAR, 1995), while, internationally status, following their citations in various international conventions and treaties: the IUCN Red list (Baillie et al., 2004), the African–Eurasian Waterbird Agreement “AEWA” (AEWA, 2008), the Washington Convention “CITES” (CITES, 1994), and conventions of Bonn.

## Results

### Specific composition of waterbirds population

A total of 52 waterbird species represent 34 genera and 16 bird families, were recorded in the study wetlands of Steppe region throughout. The species richness was varied from site to other where the high value was observed at Boughzoul reservoir with 51 species representing 16 families. However the low richness was observed at Ouled Touati Dam, with only 6 species representing 4 families.

Anatidae family was the best represented with 11 species, followed by Scolopacidae with 9 species, then by Ardeidae with 8 species. Charadriidae, Laridae and Sternidae were represented by 4, 3 and 3 species respectively. However other families were low represented (Table 1)

Boughzoul reservoir is the high richness wetland in the complex both in species (52) and families (16), followed by Chott El Hodna and K'sob reservoir. However, Ouled Touati dam is the poorest site with only 06 species and 04 families.

### Ecological status of assessed waterbirds

Winter migrant birds are the most assessed species (43 %), followed by resident breeder and migrant species with 28 % and 17 %. Whereas, another status (summer migrant, summer migrant breeder and resident species) are lower represented (Table 02, Figure 04).

The phonological status of inventoried species was varied between sites, the resident breeder was very presented in Dayet El Kerfa and Oulad Touati dam. However, Chott El Hodna, Boughzoul reservoir and K'sob reservoir avifauna is dominated by migrant passage species (Figure 05).

A total of 36 (28 %) birds protected in Algeria, and the most identified species (92.30%: 48 species) were of “Least Concern” according to the IUCN Red List, while three species (*Aythya nyroca*, *Limosa limosa*, *Numenius arquata* ) has the “ Near Threatened status, and only one species (*Marmaronetta augurostris*) has the “Vulnerable” status (Table 2).

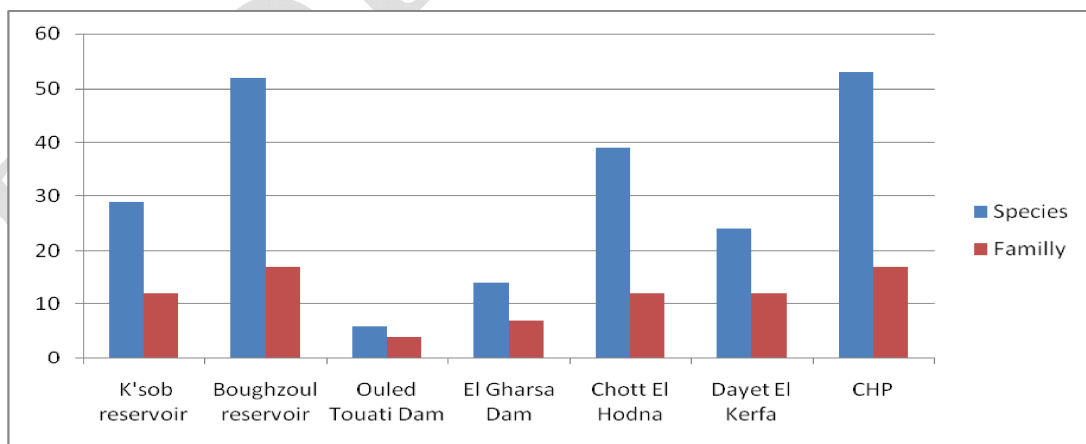


Figure 2: Distribution of families and species in different wetlands

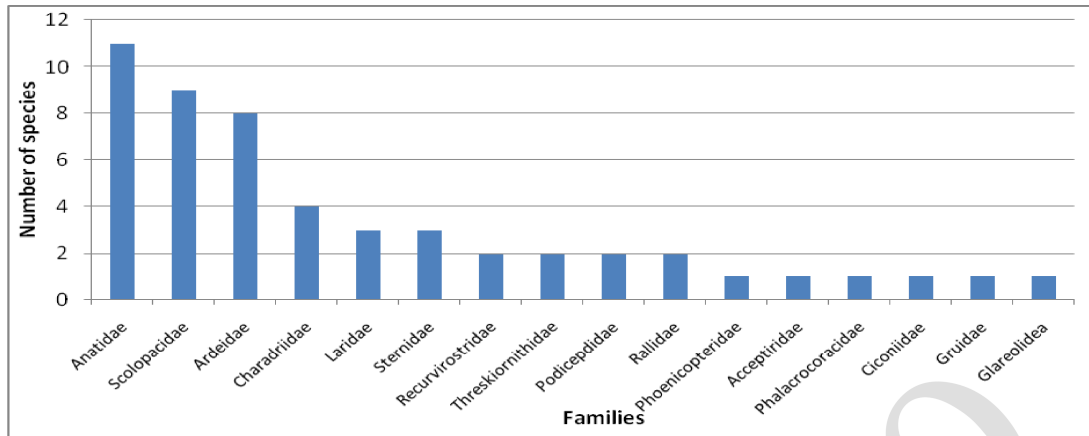


Figure 3: Species richness of different families in the study wetlands

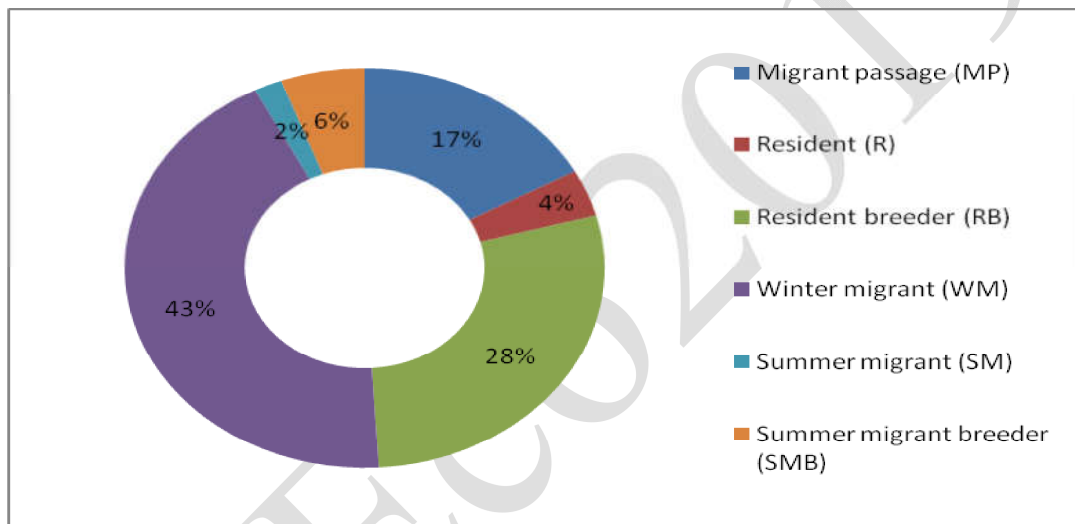


Figure 4. Distribution of waterbirds species following their phonological status in the in the study region

Table 1. Systematic list of bird species recorded in the study region with their ecological and protection status

Species (Scientific name)	Ph	FT	TC	PRS
<i>Anas platyrhynchos</i>	RB	H	Pp	LC,N2,E3,A
<i>Anas clypeata</i>	WM	H	Pp	LC,T3,N2,E3,A
<i>Anas acuta</i>	WM	P	Pp	LC,T3,N2,E3,A
<i>Anas crecca</i>	WM	H	G	LC,T3,N2,E3,A
<i>Anas penelope</i>	WM	P	Pp	LC,T3,N2,L2,E2,A
<i>Anas strepera</i>	WM	H	Pp	LC,N2,E3,A
<i>Marmaronetta angustirostris</i>	RB	S	Pp	VU,N1,D,E2,A
<i>Aythya nyroca</i>	WM	TM	Pp	NT,T3,N1,E3,A
<i>Aythya ferina</i>	MP	P	Pp	LC,N2,E3,A
<i>Tadorna ferruginea</i>	RB	PX	Pp	LC,N2,D,E2,A
<i>Tadorna tadorna</i>	RB	S	Pp	LC,N2,D,E2,A
<i>Adria cenerea</i>	WM	P	P	LC,W,A,R3
<i>Bubulcus ibis</i>	RB	IA	Inv	LC,T3,E2,A
<i>Egretta garzetta</i>	WM	OW	Inv	LC,T3,E2,A
<i>Ardea alba</i>	WM	COS	P	LC, D, R2, A
<i>Nycticorax nycticorax</i>	WM	P	Pp	LC,W,A,R2
<i>Ardeola ralloides</i>	WM	P	Pp	LC,W,A,R2



<i>Ardea purpurea</i>	MP	P	Pp	LC,W,A,R2
<i>Tringa nebularia</i>	WM	SB	Inv	LC,N2,E3,A
<i>Tringa erythropus</i>	WM	SB	Inv	LC,N2,R3,W
<i>Calidris minuta</i>	WM	ARC	Inv	LC,N2,E2,A
<i>Gallinago gallinago</i>	WM	H	Inv	LC,N2,E3,A
<i>Calidris alpina</i>	SM	ARC	Inv	LC,N2,E2,A
<i>Tringa totanus</i>	WM	P	Pp	LC,N2,E3,A
<i>Tringa stagnatilis</i>	MP	P	Inv	LC, N2, R3, W
<i>Actitis hypoleucos</i>	MP	P	Pp	LC, N2, R2, W
<i>Limosa limosa</i>	WM	ETH	Inv	NT, N2, R3, W
<i>Numenius arquata</i>	MP	P	Pp	NT,N2,W,R3
<i>Charadrius dubius</i>	WM	P	Inv	LC,N2,E2,A
<i>Charadrius alexandrinus</i>	RB	C	Inv	LC,N2,E2,A
<i>Charadrius hiaticula</i>	MP	ARC	Inv	LC,N2,E2,A
<i>Vanellus vanellus</i>	MP	P	Inv	LC,N2,E3,A
<i>Gallinula chloropus</i>	RB	P	Pp	LC,W,R3
<i>Fulica atra</i>	RB	P	Pp	LC,E3,A
<i>Plegadis falcinellus</i>	WM	AM	Inv	LC,N2,W,A,R2
<i>Platalea leucorodia</i>	WM	OW	Inv	D, LC,C2,N2,W,A,R2
<i>Podiceps cristatus</i>	RB	OW	Inv	LC,W,A,R3
<i>Tachybaptus ruficollis</i>	RB	AM	P	LC, R3, W
<i>Himantopus himantopus</i>	RB	C	Inv	LC,N2,D,E2,A
<i>Recurvirostra avesseta</i>	RB	TM	Inv	LC,N2,D,E2,A
<i>Cicinia ciconia</i>	SMB	P	Inv	LC,N2,D,E2,A
<i>Phalacrocorax carbo</i>	WM	OW	Pp	D, LC,W,A,R3
<i>Phoenicopiterus roseus</i>	R	M	Pp	LC,T2,N2,L2,D,E2,A
<i>Larus ridibundus</i>	RB	P	Pp	LC,E3,A
<i>Larus genei</i>	RB	S	Pp	LC,N2,E2,A
<i>Larus cachinnans</i>	WM	(-)	Pp	LC,E3,A
<i>Sterna nilotica</i>	RB	C	Pp	LC,E3
<i>Chlidonias hybrida</i>	MP	AM	Inv	LC, D, R2, W
<i>Chlidonias niger</i>	MP	H	Inv	LC,W,R2
<i>Circus aeruginosus</i>	R	P	C	LC, N2, D, R3
<i>Grus grus</i>	WM	P	Pp	LC,T2,N2,D,E2,A
<i>Glareola pratincola</i>	SMB	IA	Inv	LC,N2,E2,A

## Discussion

Steppe region wetlands of Algeria by this exceptional biodiversity remain unexplored until now. During the study period through four years, around 52 waterbirds species representing 16 families were recorded in the whole complex. Inventoried species in this wetland complex represent a considerable number of waterbirds, 52 from 99 waterbirds species were identified in Algeria (Samraoui et al. 2011), and represents 12.8 % of all Algerian birds (406 species cited by Isenmann & Moali, 2000).

These species represent different phenologic status: 22 winter migrant species (43%), 15 resident breeder species (28%), 9 migrant passage species (17%), and three (6%) summer migrant breeder species. However, some species have two different statuses, may be due to the existence of two distinct populations that use the site.

The family of Anatidae is the most represented in terms of richness and numbers by ten species. Other families are poorly represented, except those of Scolopacidae and Charadriidae with 09, 08 and 04 species respectively.

For some breeding species, their breeding was confirmed as Ruddy Shelduck *Tadorna ferriginea* in the most of wetlands. This species was previously observed in winter by Jacob & Jacob (1980) at neighbor site (Lake of Boughzoul) with a small number.

Among all recorded species, 36 species are protected under Algerian law pursuant to Decree No. 83-509 of August 20, 1983, and the Order of January 15, 1995 completing the list of non-domestic protected animal species. Marbled Teal *Marmaronetta angustirostris* species of greatest conservation listed as Endangered Species in the category (VU) of Red List by the International Union for Conservation of



Nature (Birdie International 2004). The latter species is present with a relatively high number in three breeding sites (Chott El Hodna, Dayet El Kerfa and Boughzoul reservoir), could explain the favorable conditions for breeding, particularly the security. This species has been cited only in Chott El-Hodna (Gurgueb et al. 2014) as breeder, in Boughzoul reservoir and Dayet El Kerfa as summer migrant non-breeder.

The distribution pattern of waterbird species via families has differed between sites, these variations explained by the combination of the variability of offered habitats in this wetland complex and ecological requirements of assessed species. While, Anatidae, Podicipedidae, Ardeidae, and Laridae are very represented in depth and freshwater wetlands. Whereas, Rallidae, Recurvirostridae, Charadriidae, and Scolopacidae are most abundant in the salt marsh and large wetlands.

At the end of this study, the steppe region wetlands seem to play a great role in the wintering and breeding of waterfowl and also serve as a stopover site for migrant species during their trans-Saharan migration journeys.

Widely recognized and due to the presence of the near threatened (the site regularly holds a species of global conservation concern: the Marbled Teal *Marmaronetta angustirostris*).

The waterbirds assessment in these wetlands indicates the regional importance of this part of the country and also supports their classification as Ramsar sites and Important Bird Area "IBA" because of the importance, richness, and abundance of avian species it shelters and hosts (BirdLife International, 2004). Throughout our surveys, some waterbirds of these wetlands are vulnerable to many threats (human disturbance, pollution, habitats fragmentation), especially those near to cities and had a socio-economic role such as K'sob reservoir and Boughzoul reservoir. However, this internationally important wetland presents a priority for conservation action which needs urgent intervention by local authorities to settle a management plan. These initiatives, if instituted, should provide effective protection to the waterbirds of steppe region wetlands.

### **Acknowledgements**

We thank the members of Association Nationale Algérien d'Ornithologie (A.N.A.O), and the PhD students of University of Oum El Bouaghi for their assistance.

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